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ABSTRACT

Participants in a teacher workshop compared these two approaches to learning outcomes in adult numeracy: (1) teaching mathematical skills and (2) using and applying mathematics from real life. The first approach was illustrated by an Ontario, Canada, program based on traditional school math, whose outcomes are skill-based and are the following: perform basic operations with numbers, use measurements, solve geometric problems, manage data and probability, and use patterning and algebra. The second approach was illustrated by an Australian program that uses social purpose and meaningful context of mathematics and whose outcomes are organized in these four categories: (1) numeracy for practical purposes; (2) numeracy for interpreting society; (3) numeracy for personal organization and (4) numeracy for knowledge. The attendees participated in developing teaching ideas, using the learning outcomes, and a final discussion. The participants agreed that the Ontario outcomes are based on math and the Australia outcomes on context. Teachers who preferred traditional math curriculum preferred the Ontario program, while more holistic approach teachers preferred the Australia program. Teachers who are not math trained might find the Australia program easier to work with. If a balance between function and skill development is sought, the Australian program may better represent the aims and ideals of adult basic education. (SLR)

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Learning Outcomes: Skills or Function?

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Abstract

Skills or function? That's the question. How should learning outcomes in adult numeracy reflect this dichotomy? In the workshop, two different approaches to describing learning outcomes were used to promote a discussion among participants around the role of skills and function within an adult numeracy curriculum. In the first part of the workshop, participants worked in small groups to analyse some different real life stimulus materials to develop some teaching ideas, then to try to see how these would fit against two models representing the above two approaches for describing learning outcomes. In the second part, participants discussed their experiences and looked at the differences and the merits of the two approaches.

Background

In the past, adult literacy and basic education has mainly been an informal, student focused form of education with no formal accreditation process or system wide curriculum, with students learning reading, writing, mathematical, oral communication, and general education skills. But in the 1990s the pressure of competency based education and training has meant that the Adult Literacy and Basic Education field too has been required to develop accredited curricula based on competency based learning outcomes.

It has been the challenge therefore to develop accredited curricula that try to espouse and maintain the principles established for a student-focused and relevant form of education. It seems that there have been two different approaches to describing learning outcomes: base them on teaching mathematical skills, often replicating school-based views on teaching mathematics, or base them on functional mathematics, on using and applying mathematics in real life.

Two Different Approaches

In Ontario, Canada, learning outcomes for numeracy are being implemented based on traditional school math strands (number, measurement, space and shape, data, and algebra). They are essentially skill-based outcomes. These are called the Literacy and Basic Skills (LBS). The LBS matrix features the following learning outcomes for numeracy:

- Perform Basic Operations with Numbers
- Use Measurement for Various Purposes
- Solve Geometric Problems
- Manage Data and Probability
- Use Patterning and Algebra

The LBS learning outcomes for numeracy come directly from the Common Curriculum now being used in the elementary schools in Ontario and as such are very hierarchical and structured and don't take into account how adults learn.

For details of one of the LBS Learning Outcomes see Appendix 1.

In Australia, numeracy learning outcomes have been developed which focus on the social purpose and use of mathematics within meaningful contexts. The outcomes include skills and knowledge in an organisational structure based on function where mathematics is seen as the knowledge and skills to be applied and used for a

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range of purposes and in a variety of contexts. These are called the Certificates in General Education for Adults (CGEA).

The Learning Outcomes are organised into four different categories or domains, according to different purposes and functions of using mathematics.

- **Numeracy for Practical Purposes** addresses aspects of the physical world to do with designing, making, and measuring. There are two learning outcomes: **Numeracy for Practical Purposes - Design** and **Numeracy for Practical Purposes - Measuring**.
- **Numeracy for Interpreting Society** relates to interpreting and reflecting on numerical and graphical information of relevance to self, work, or community. The two learning outcomes are: **Numeracy for Interpreting Society - Data** and **Numeracy for Interpreting Society - Numerical Information**.
- **Numeracy for Personal Organisation** focuses on the numeracy requirements for personal organisational matters involving money, time, and travel. There are two learning outcomes, one dealing with money and time, the other to do with location and direction.
- **Numeracy for Knowledge** is only introduced at level 3 and deals with mathematical skills needed for further study in mathematics, or other subjects with mathematical underpinnings and/or assumptions. There are learning outcomes to do with problem solving, algebraic, and graphical techniques.

For details of one of the CGEA Learning Outcomes see Appendix 2.

Developing Teaching Ideas
Sets of three different functional materials or stimulus materials were distributed to small groups of participants. (They were: a tourist map of Boston; a menu from the Near East Cafe; and a newspaper article: "American League baseball standings.")

The question that was posed was:

> *What would you teach with these materials if they were brought to your classroom by your students?*

A wide range of teaching ideas and activities were developed by the different groups. These ideas were shared by the whole group. This illustrated how much math was embedded within such common materials.

Using the Learning Outcomes
A brief explanation of the two Learning Outcome schemes (CGEA and LBS) was given and excerpts from the two frameworks were distributed.

The question that was posed here was:

> *How would you fit the learning activity that you just discussed into each of these frameworks? In other words, "map" the activity to the learning outcome.*

This was done to also illustrate and model to participants that no matter what the standards or curriculum frameworks that are introduced or imposed upon teachers, it is possible to start with what students want or are interested in, and then afterwards to map the activity to the learning outcome rather than try to start with the standards or learning outcomes.

The Discussion
Two questions were posed here:

- *What are the differences between these two frameworks?*
- *What are the advantages and disadvantages of the two frameworks?*

Here it was almost unanimously agreed that the main difference was that the Ontario LBS outcomes are based on "Math" while the Australian CGEA outcomes are based on "Context." However, it was agreed that both can get to the same end—it depends on learning styles, on different ways of looking and viewing the world of math and numeracy.

It appeared that those teachers who were more inclined to teaching a traditional math curriculum found the Ontario LBS scheme much more comfortable and user friendly, whilst those who taught in a more holistic and integrated way, often where literacy and numeracy were taught together, found the Australian CGEA scheme more attractive. One argument that was raised was that for teachers who are not math trained, the Australian CGEA Learning Outcomes were much more understandable and would be easier to work to.

Conclusion
Alan Mortiboys (1984) warned against the extremes of teaching mathematical skills without a context or of adopting a purely functional approach with myriads of timetables, menus, and advertisements. Terry Riley (1984) concluded: "We need to adopt a balanced approach: one in which mathematical rules are understood and practised, and where appropriate, used in situations deemed to be relevant to the student by the student." Although these references seem old, this balanced approach, where function is integral, is based on principles of adult learning that are rooted in context and relevance to every day life.

One of the dangers of following a school-based approach such as in the LBS outcomes and in the absence of curriculum guidelines and appropriate training, is that literacy instructors who have little training in numeracy will use these learning outcomes as the prescribed course of study. One literacy tutor has already expressed her difficulty in understanding the schema, for example with the success marker which states: "models numbers grouped in 10s and 1s and uses zero as a place holder." This terminolgy is too abstract for a literacy practitioner who has no formal training in mathemetics. Furthermore, new assessment tools based on the LBS learning outcomes look like the school tests that failed literacy learners in the past.

We believe that numeracy provision needs to be a balance between function and skill development. The CGEA scheme says that mathematics skills are an important and vital part of the Learning Outcomes, but they are not the up front focus—the function or purpose is the organising structure. In that sense we believe therefore that the Australian Certificates in General Education for Adults Numeracy and Mathematics Learning Outcomes better represent the aims and ideals of adult basic education. As such they have better met the challenge to develop accredited curricula that try to espouse and maintain the principles established for a student-focused and relevant form of education.

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Appendix 1 **Ontario Literacy and Basic Skills Program (LBS)**

Sample LBS Learning Outcome

Learning Outcome: Manage Data and Probability – Concluding and Reporting

Level 1
Success Markers

- relates objects to numbers on a graph with one-to-one correspondence [1]
- records data on charts or grids given by the instructor [1]
- organises materials on concrete graphs and pictographs using one-to-one correspondence [1]
- reads and discusses data from graphs made with concrete materials and demonstrates understanding in a variety of ways (for example: use informal language to discuss) [1]

Level 2
Success Markers

- relates objects to number on a graph with many one-to-one correspondence (for example: 1 Canadian flag represents 100 Canadian citizens) [3]
- organises data in Venn diagrams and charts using several criteria [3]
- constructs bar graphs (with discrete classes on one axis and number on the other) and pictographs using scales with multiples of 2, 5, and 10 [3]
- interprets data from graphs (for example: bar graphs, pictographs, and circle graphs) [3]

Transition Markers

- identifies the parts of a graph: labels, scales, title, data [2]
- organises data using graphic organisers (for example: diagrams, charts, graphs, webs) and various recording methods (for example: placing stickers, drawing graphs) [2]
- constructs and labels simple concrete graphs, bar graphs, and pictographs using one-to-one correspondence [2]
- interprets displays of numerical information and expresses understanding in a variety of ways (for example: use informal language to discuss) [2]

Level 3
Success Markers

- recognises that graphs, tables, and charts can present data with objectivity or bias [5]
- constructs labelled graphs both by hand and by using computer applications [5]
- evaluates data presented on tables, charts, and graphs and uses the information in discussion (for example: discusses patterns in the data presented in the cells of a table that is part of a report on a scientific experiment) [5]

Transition Markers

- recognises the purposes of different parts of a graph: title, labels, axes [4]
- constructs labelled graphs (for example: labelled with titles, horizontal and vertical axes, intervals, and data points) both by hand and by using computer applications, and creates intervals suited to the range and distribution of the data gathered (for example: a graph with a range of 100 years is better divided into intervals of 10 years than 1 year) [4]
- reads and interprets data presented on tables, charts, and graphs (for example: circle graphs) and discusses the important features [4]

Note: *(1) This learning outcome "Concluding and Reporting" has two more levels: 4 and 5.*
(2) The number at the end of each Success or Transition Marker, e.g., [4], denotes the corresponding grade level in the Ontario Elementary School Common Curriculum.

Appendix 2 The Certificates in General Education for Adults (CGEA)

Sample CGEA Learning Outcome

Learning Outcome 2.5: Numeracy for Interpreting Society - Data

Can use and create everyday graphs and charts to represent and interpret public information which is of interest or relevance.

Assessment criteria

Not all assessment criteria need to be met in the one assessment task or activity

Mathematical Knowledge & Techniques

(a) interpret the key features, conventions and vocabulary of everyday graphs or charts, including the concept of scale

(b) use whole numbers, percentages, decimals and simple ratios found on charts and graphs

(c) collect, sort and record data in a table using simple techniques

(d) interpret and discuss meaning of text that incorporates graphs or charts

(e) mark scales and axes appropriately

(f) represent data in simple bar or line graphs

Language

(a) use the descriptive language of graphs and charts such as maximum, minimum, increasing, decreasing, going up, constant, changing, slope, etc.

Interpretation

(b) relate meaning/information of graph or chart in terms of personal implications and/or social consequences

(c) decide on the fairness or bias of the data in response to teacher prompting.

Performance range

- The types of graphs or charts could include simple pie charts, bar graphs, line graphs, pictograms, etc. of the kind found in newspapers, on household bills, information leaflets, etc.
- Scales created should count in 1's, 2's, 5's or 10's.
- Scales interpreted from public information not limited to the above simple scales - can interpret from more complex scales available on public information.

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